Development and Assessment of an Oscillatory Motion Tutorial

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Introduction

- Interpreting graphs is critical for developing an understanding of many topics in physics (McDermott, 1987)
- Our previous research has found students have difficulty extracting information from graphical representations.
- **Goal: Create a short tutorial to improve student understanding of mathematical and graphical representations of oscillatory motion.**

Methods

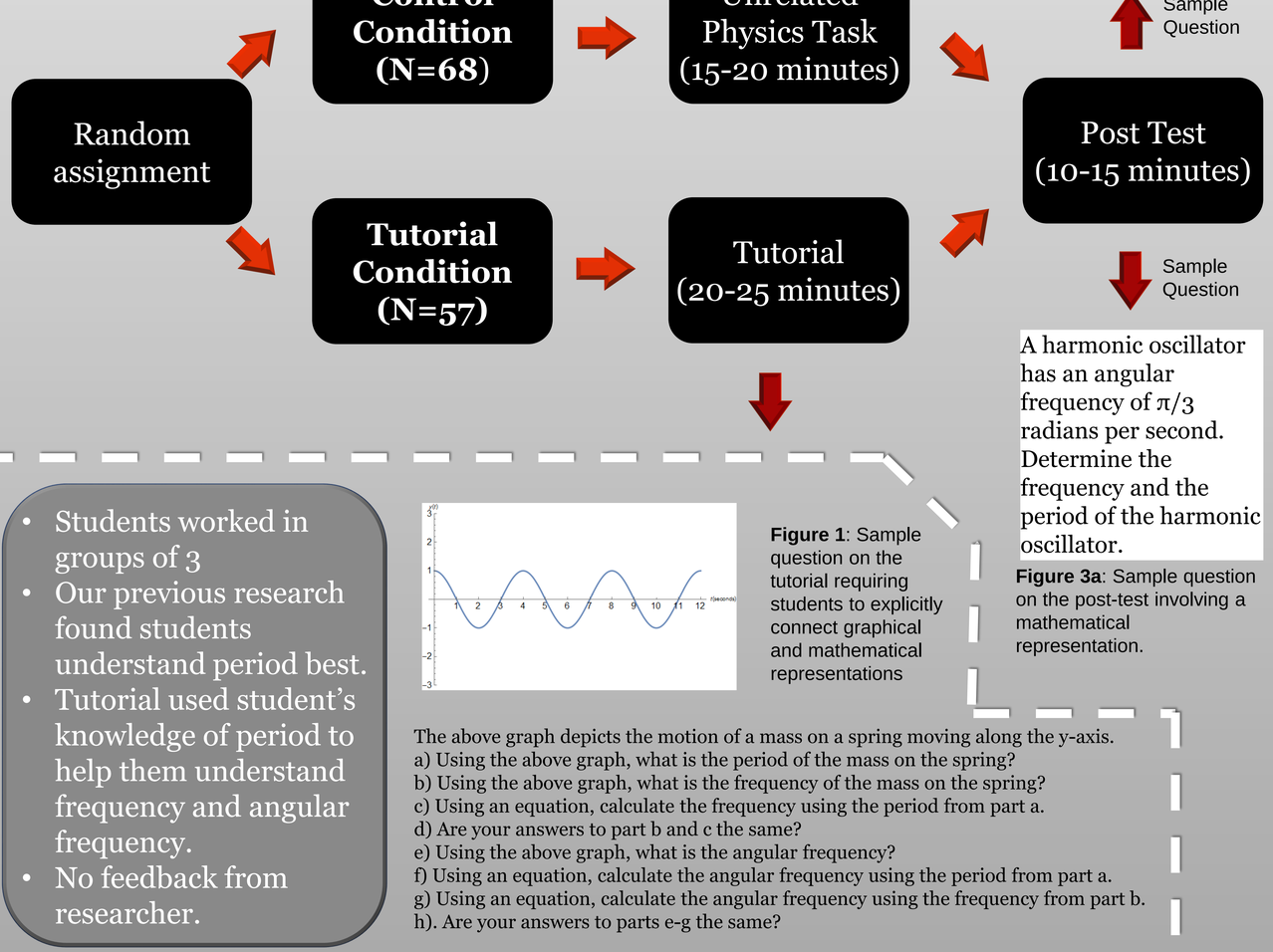

Figure 1: Sample question on the tutorial requiring students to explicitly connect graphical and mathematical representations

Figure 3a: Sample question on the post-test involving a mathematical representation.

Results

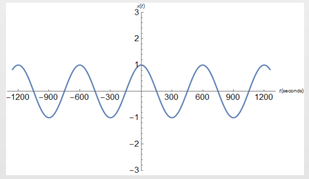

Figure 2a: Sample question on the post-test involving a graphical representation.

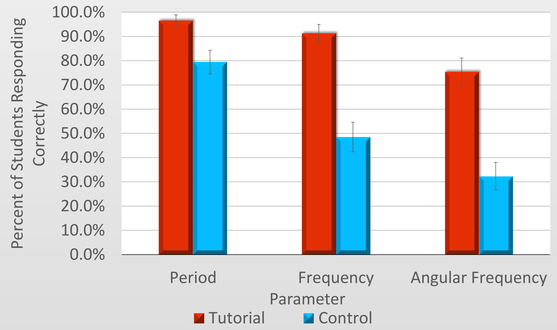

Figure 2b: Student performance on the question depicted in figure 2a. The results are representative of similar questions on the post-test. Error bars are ±1 S.E.

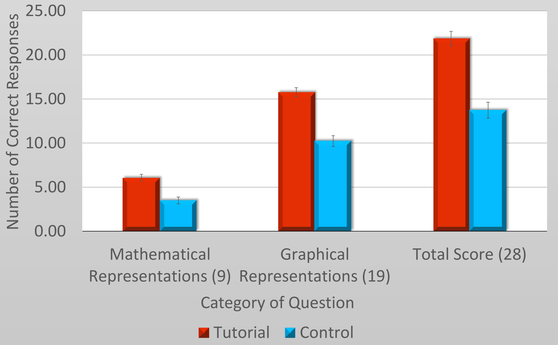

Figure 4: Overall student performance on the post-test. Mathematical representation questions are those similar to questions shown in figure 3a while graphical representation questions are those similar to the question shown in figure 2a. The number in parentheses is the number of questions in the category. Error bars are ±1 S.E.

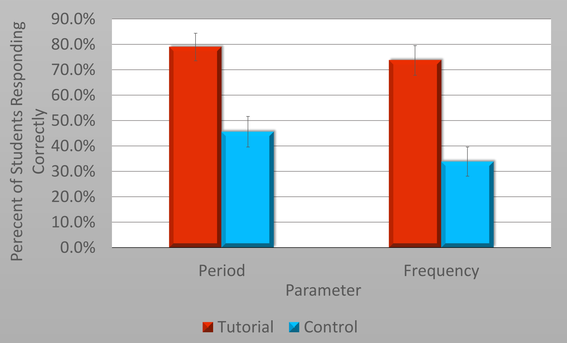

Figure 3b: Student performance on the question depicted in figure 3a. The results are representative of similar questions on the post-test. Error bars are ±1 S.E.

Conclusions

- **Overall, post-test performance in the tutorial condition was significantly greater than in the control condition** ($t(123)=6.568$, $p<.001$).
- Corresponds to substantial effect size ($d=1.17$)
- Students in the control condition and tutorial condition both did best on questions involving the period and worst on questions involving the angular frequency.

Future Research

- Investigate the relation between student understanding of graphical representations and mathematical representations.
- Investigate possible hierarchies between determining the period and frequency from graphical and mathematical representations.
- Incorporate the tutorial into our online practice application for introductory physics students.

Acknowledgements

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